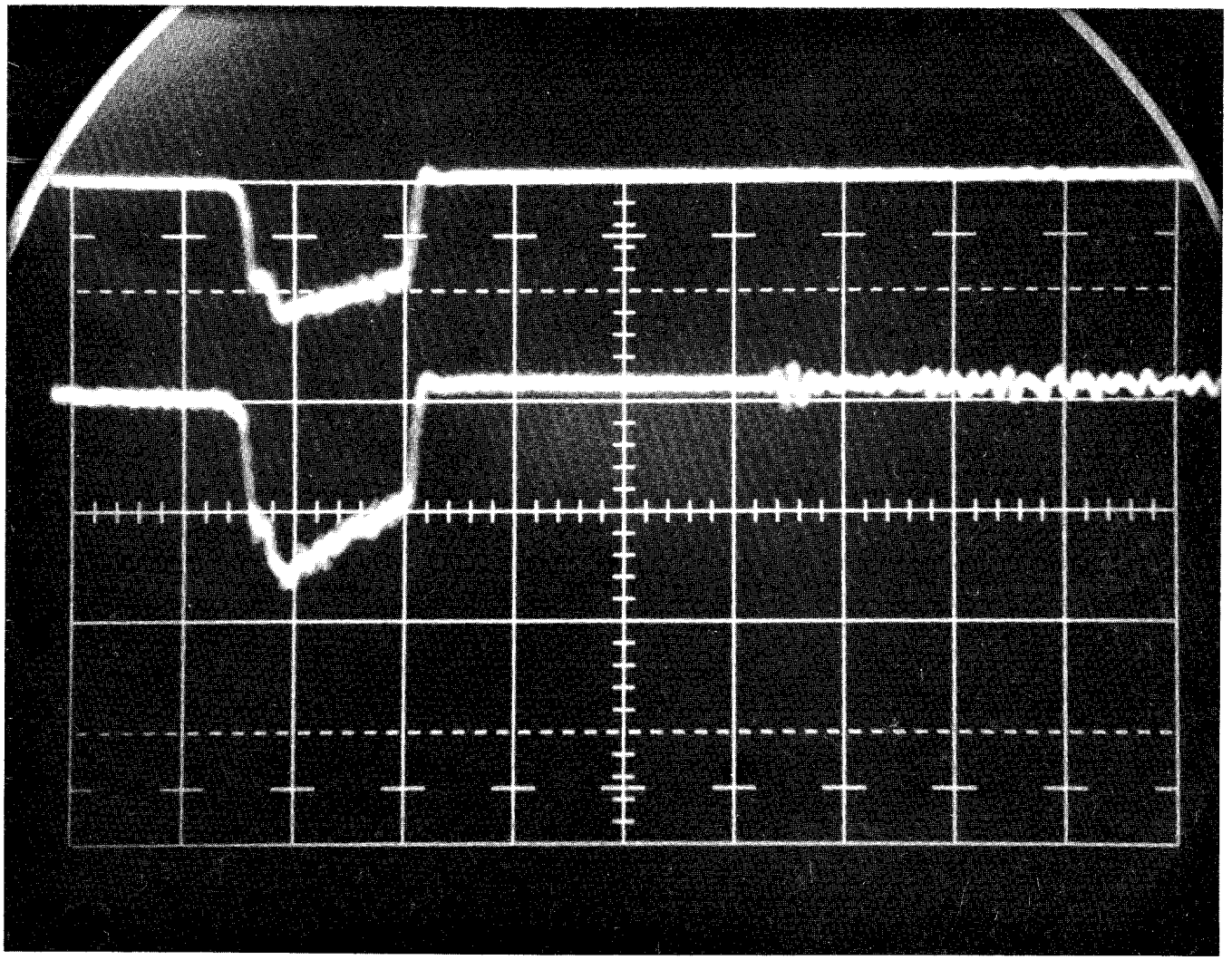
national accelerator laboratory FERMILAB-NAL-051

MONTHLY REPORT OF ACTIVITIES

November 30, 1970



200-MeV BEAM

Operated by Universities Research Association Inc. Under Contract with the United States Atomic Energy Commission

FORTHCOMING MEETINGS

Dec. 11-12	Program Advisory Committee
Dec. 12	NAL Users Executive Committee (O'Hare)

THE COVER: The first oscilloscope traces of 200-MeV beam. The lower trace is beam current measured on a toroid just beyond the end of the linac. The upper trace is beam current measured on a toroid beyond the spectrometer that measures the beam momentum. Each large vertical division corresponds to 10 milliamperes; each large horizontal division corresponds to 10 microseconds.

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MONTHLY REPORT OF ACTIVITIES

F. T. Cole

November 30, 1970

Abstract: This report summarizes the activities of the National Accelerator Laboratory in November, 1970.

Linac

Installation of the linac has been completed and 200-MeV operation achieved on November 30. The cover photograph shows the first beam trace through the spectrometer (and thus the first confirmation of 200-MeV energy). An accelerated current of over 20 milliamperes was observed, although no effort was made to accelerate a high intensity. Figure 1 is a copy of an

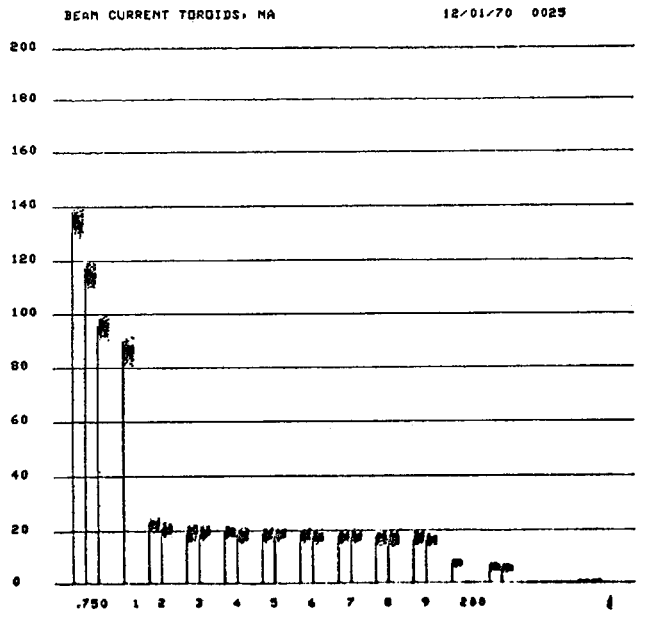

Fig. 1. Beam current through the linac (taken about an hour after first operation). The vertical scale is current in milliamperes and the horizontal scale is tank number (with injection and final energies added). The blobs are collections of individual points from many runs. The losses during injection and bunching in the first tank can be seen.

oscilloscope plot of beam current measured at various points along the linac. It is planned that much of December will be occupied with efforts to increase the intensity and to measure and optimize beam properties.

Main Accelerator

Some effort in November went into re-evaluating the production and installation of components done up to this time. Magnet production was slowed by this re-evaluation. As of the end of November, a total of 421 magnets have been completed and 234 installed. With the experience gained in installation of the first superperiod, it is possible to estimate much more accurately the amount of installation work required in the remaining five superperiods. It is therefore planned that the work in the major areas (setting magnet bases, placing magnets, cabling, vacuum-system hook-up, installation of service-building substations) will be carried out under fixed-price contracts, instead of the time-and-materials contracts used in the first superperiod.

Booster

All but a few magnet girders have been placed in the ring. The major holdup has been that some magnets from one vendor have been found to be twisted beyond the specified tolerance. This has necessitated the rearrangement of contracts so that more magnets will be built by another vendor under the options of his existing contract and by the Laboratory.

Meanwhile, full-power tests are being carried out on the already installed part of the ring, including power-supply operation through the control system. The 200-MeV injection-system magnets are also being operated and tested.

Radio Frequency

The Booster rf stations (16 rf cavities, tuners, and amplifiers on 8 girders) are all assembled and installed in the Booster tunnel, with the last one going in on November 13. Figure 2 shows a complete Booster rf station

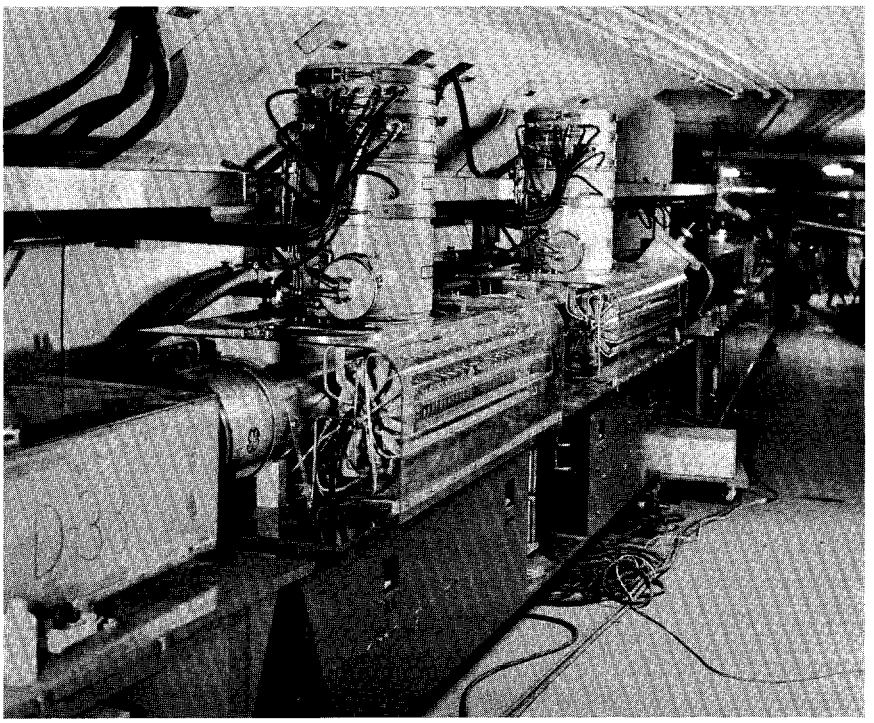

Fig. 2. A booster rf station. The end of the near cavity projects beyond the plexiglass cover. Ferrite tuners are also visible under the cover. The power amplifier and drivers are above in the cylindrical housings. The booster injection area can be seen in the background.

in place. Water and electrical connections are complete and vacuum connections in progress. The anode power supplies are now being installed in the Booster galleries.

A design change has been made in the harmonic mode-damping system of the main-accelerator cavity, discussed in previous reports. The damping ferrite is to be relocated from near the accelerating gap to a mounting on the end walls of the cavities, with rf coupling through apertures in the end walls.

The problems encountered in mounting metallized and brazed ferrite slabs near the gap will continue to be investigated for possible later use.

Construction

1. Main Accelerator. A significant milestone was reached on November 30, when the last precast tunnel section of the main accelerator was placed. Figure 3 is a photograph of this happening. It is especially gratifying that this occurs just two years from the groundbreaking for the construction of the Laboratory and only eleven months from the time the contract was let for this five-sixths of the ring. In addition, the RF Building is now occupied by the

Fig. 3. The last precast tunnel section (marked "Nelson Banks").

Laboratory. Figure 4 is an aerial view of the entire main ring and Fig. 5 is a photograph of the RF Building. The Phase II contract as a whole is 85% complete.

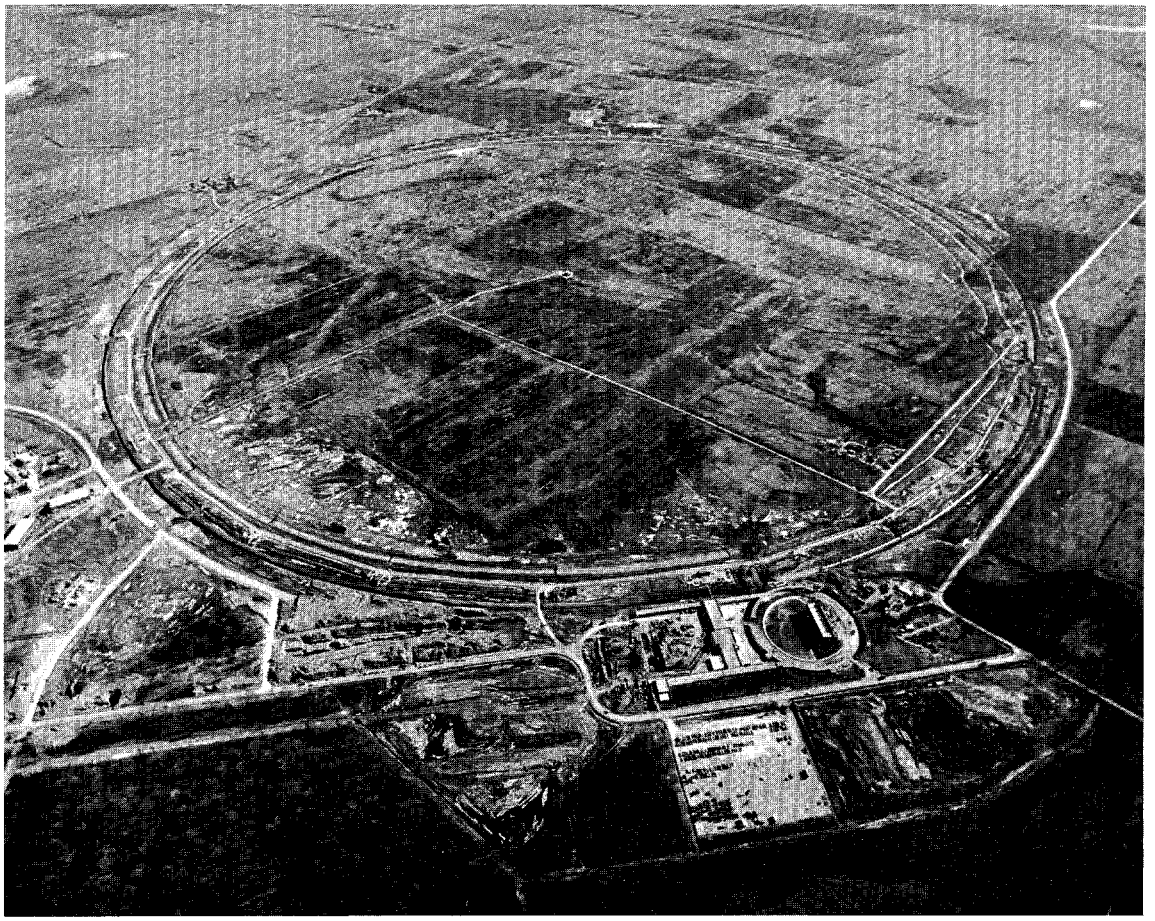

Fig. 4. The site from the air looking southeast. The tunnel is still uncovered to the right. The excavation for the Central Laboratory can be seen in the "U" of the injection area. At the left of the injection area, one can see the excavation for the proton beam line. The new road to the Laboratory Village curves off to the left.

Fig. 5. The RF Building, looking due south. The road beyond is Kautz Road, one of the original roads on the site. It is also the boundary line between DuPage and Kane Counties. The tunnel south of the RF Building had not been completed when this picture was taken.

2. Electrical Substation. The first of the three large transformers has arrived and been put in place. Figure 6 shows it being unloaded from the freight car. The second and third transformers are scheduled to arrive in the near future. System checkout is in progress on the remainder of the substation. The contract is 94% complete.

3. Proton Beam. Excavation and forming work is going on between the Transfer Hall of the Main Accelerator and the Electrical Substation.

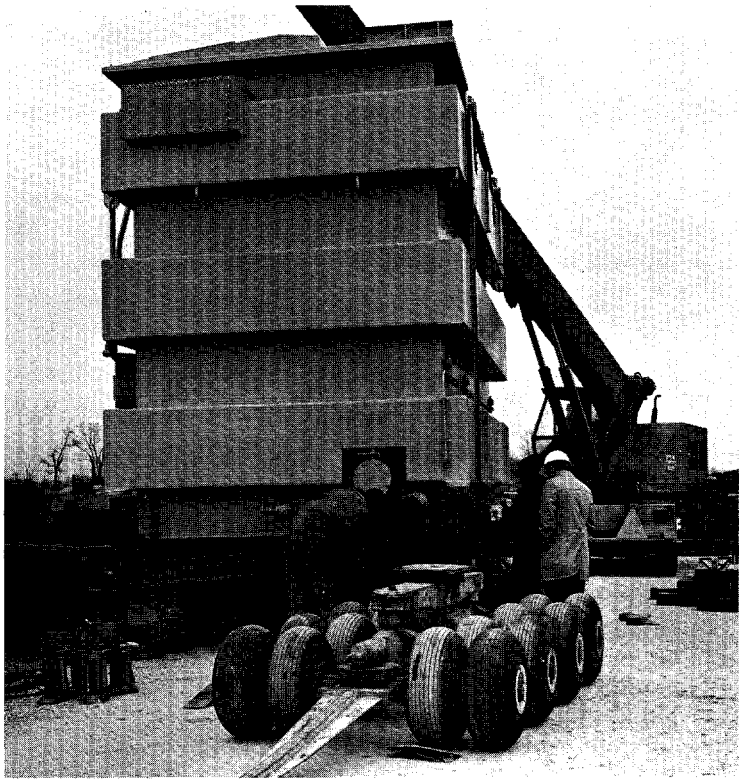

Fig. 6. The first 345-kV transformer being unloaded at a railroad yard in Eola, south of the site. The transformer has since been placed in the substation.

Figure 7 is an aerial view of this work. Access tunnels and beam lines are being formed beyond the Substation. The contract is 41% complete.

4. Central Laboratory. Caisson work is approximately three-fourths completed. Excavation work has begun at the south end of the structure, toward the Cross Gallery. This work can be seen in Fig. 8 from the ground and in Fig. 9 from the air. Phase I, the part under contract, is 15% complete.

5. Meson Laboratory. Site clearing and grading has begun on the first phase of the Meson Laboratory, which includes the target area. Figure 10 shows this work. Bids, one of which is remarkably low, have been received on the second phase, which will carry the work up to the detector building.

Fig. 7. Work on the proton beam line, looking north along Road A. The Substation is at the upper left, the Main Ring at the right. The cleared site of the third Industrial Building can be seen to the left of the silo at the top.

Fig. 8. Excavation for the Central Laboratory. The view is from in front of the Linac Building. Service Building SA-5 of the Main Ring is in the distance, just to the left of the crane at the right. The pipes are caisson shells. In the foreground is the utility tunnel under construction. The upper layers of the sides of the excavation are a yellow clay and the lower layers are a blue clay, both vividly colored in real life.

Fig. 9. The injection area from the air. The Central Laboratory is at the left behind the Linac Building The earth shielding at the high-energy end of the Linac is visible, where the large door has been covered. Kautz Road is at the upper right. The Booster pond, not yet in operation, has the first ice of the winter.

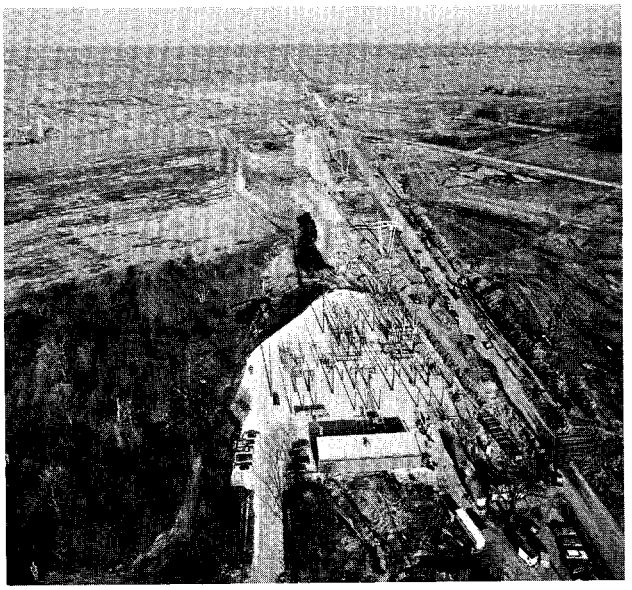

Fig. 10. Looking north along Road A. The Substation is in the foreground (the transformer of Fig. 6 has since been set on its pad at the upper left of the building). Clearing work for the Meson Laboratory is visible to the left of the power line.

6. New Contracts. Two significant new contracts were let in November. The target area of the Neutrino Laboratory is under construction by the Schless Construction Co. of Batavia (who built the Linac Building, the Cross Gallery, participated in a joint venture that has built the first superperiod of the Main Ring and are now constructing parts of the cooling and utility systems). The contract is for $982,500.

An Industrial Building (for stores and receiving) is being constructed by the Kaiser-Ducett Co. of Chicago. The value of the contract is $404,400. Its site can be seen in Fig. 7.

Experimental Facilities

1. Meson Laboratory. Progress on construction is discussed above. In addition, plans and schedules for the early experiments are being developed. The overall time schedule provides that two to three secondary beams may be in preliminary operation in mid-1971, another one to two by the end of 1971 and all beams by mid-1972.

2. Neutrino Laboratory. Construction of the target area has begun, as discussed above. A possible modification of the target box is being studied prior to giving notice to proceed on that part of the work.

The design of the Muon Laboratory, which is approximately three-fourths of the way down the neutrino shield from the target, has been firmed up in collaboration with experimenters who have approved proposals for this work.

3. Bubble Chamber. A contract has been let for 18 fish-eye windows for the bubble chamber, that is, windows for 6 camera ports. Figure 11 is a drawing of our camera port showing the assembly of the windows. The same vendor

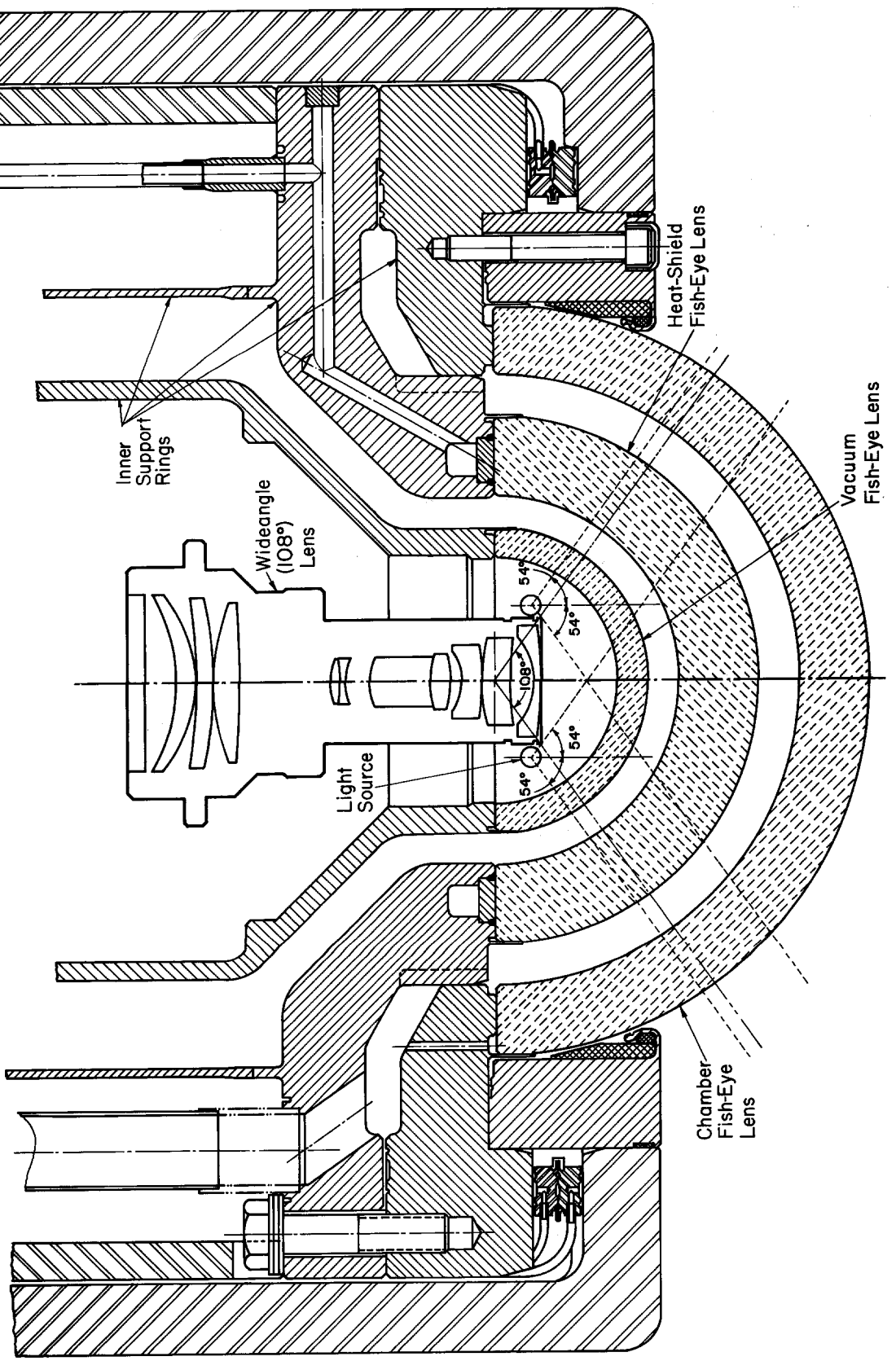

Fig. 11. Detail of a camera port of the 15-foot bubble chamber, showing the fish-eye lenses.

fabricated the windows for the Argonne National Laboratory 12-foot chamber. Our Laboratory has also benefited greatly from the cooperation of CERN physicists. We used the drawings and specifications developed at CERN for their 3.7-meter chamber.

Shop drawings for the chamber vacuum tank have been approved and fabrication will begin in December. Many other components are under construction or out for bids.

4. Experiments. A meeting was held November 16 to discuss the pion charge-exchange scattering experiments that have been proposed by a number of groups (Proposals 55, 84, and 93). As a result of this meeting, Alvin Tollestrup has agreed to serve as principal scientist and will form one group for the experiment.

Another preliminary meeting was held to discuss the use of small and rapid-cycling chambers at the Laboratory. Considerable interest was adduced and the group is continuing to meet to discuss beams to the 30-inch chamber and its physical location and peripheral equipment.